EPIDEMIOLOGY, STATISTICS and PSYCHOSOMATIC

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THE COUNCIL FOR TOBACCO RESEARCH - U.S.A.

SUCCESSOR TO THE
TOBACCO INDUSTRY RESEARCH COMMITTEE
633 THIRD AVENUE
NEW YORK, N. Y. 10017

COMMITTEE:
Dr. Cattell, Chm.
Dr. Little
(Dr. Seltzer)

Application For Research Grant

Date: January 25, 1966

1. Name of Investigator: Norman W. Heimstra, Ph.D.

2. Title: Assoc. Prof. Psychology, Director, Driver Behavior Laboratory

3. Institution & Address: University of South Dakota
Vermillion, South Dakota

4. Project or Subject: An investigation of the relationship between smoking deprivation and stress

5. Detailed Plan of Procedure (Use additional pages if more space is required.)

(See attached proposal)

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6. Budget Plan:

a.	Salaries	$6800
b.	Expendable Supplies	900
c.	Other Expenses	550
d.	Permanent Equipment	
e.	Overhead (15% of a, b, c)	1237
	Total	$9487

7. Anticipated Duration of Work:

June 1, 1966 - December 31, 1967 (18 months)

8. Facilities and Staff Available:

Facilities and staff are available to conduct this investigation. Direct supervision will be by Dr. Heimstra. Staff at the medical school will be available for consulting and for analysis of blood and urine. Tracking and reaction time equipment will be constructed. All other equipment is available.

9. Additional Requirements:

None

10. Additional Information (Including relation of work to other projects and other sources of support):

The proposed investigation relates to other work being conducted in the laboratory which is being funded by government agencies. Closely related are projects on the effects of environmental stress on performance which are currently being conducted. Procedures and equipment utilized on these investigations can be utilized on the proposed study.

Signature Norman Heimstra
Director of Project

Fred E. Marshall
Business Officer of the Institution

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An Investigation of the Relationship Between Smoking Deprivation and Stress

INTRODUCTION

In a recently completed investigation at the Driver Behavior Laboratory at the University of South Dakota, the effects of smoking on performance in a simulated driving device was investigated.[1] The experimental design involved three groups of subjects: a non-smoker group, a smoker group and a smoker-deprived group. While few differences in performance were noted in the case of the smoker and non-smoker groups, performance of the deprived smokers was consistently inferior to that of subjects in the other groups. There were several indications that subjects in the smoker-deprived group were under considerably more stress than subjects in either the smoker or non-smoker groups.

While no direct evidence was obtained to verify the possibility of a higher level of stress in the deprived group, their behavior strongly suggested this. In several instances subjects refused to continue with the driving task even though they were aware that they would not be paid if they did not continue. Also, several subjects became quite aggressive in an overt fashion. Comparison of the data obtained from the smoker-deprived group showed that is was very similar to data obtained in an investigation in this laboratory where subjects were intentionally stressed by means of electric shock. In addition, comments made by subjects after completion of the task indicated that they considered it to be stressful.

Although considerable research relating smoking with various behavioral and physiological measures has been accomplished, little interest has been shown in the possible effects when individuals are intentionally deprived of smoking. This is somewhat surprising considering the efforts directed at isolating and specifying withdrawal effects of many other types of chemical agents.

The purpose of the proposed investigation is to determine, by means of behavioral and physiological measures, the effects of smoking deprivation on "light" and "heavy" smokers.

METHODS

Subjects

Subjects will be male college students recruited from

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1 Supported by a grant from the Council for Tobacco Research, U.S.A.

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various classes at the University. Subjects will be paid to participate in the investigation.

Students will be requested, in their classroom, to fill out a short questionnaire about their smoking habits. While a number of questions will be included, the items of primary importance for this study will be whether the individual smokes, ever smoked, the frequency of smoking and whether he inhales regularly. On the basis of this questionnaire, potential subjects will be classed as non-smokers, light smokers and heavy smokers.

The difficulties of a classification of this type is recognized and has been discussed by Larson, Haag and Silvette.[1] However, in this study a light smoker will be defined as one that smokes between five to ten cigarettes a day and indicates that he inhales regularly. A heavy smoker is operationally defined as one that smokes over 20 cigarettes daily and inhales regularly.

Subjects, on the basis of their replies to the items on the questionnaire will be contacted as possible subjects--they will be approached by phone and again, in a casual fashion, asked several questions about their smoking. If their answers regarding the frequency of smoking and inhalation correspond to their questionnaire responses they will be asked to serve as subjects.

Health records of all subjects selected will be routinely examined to screen for any obvious physical defects--all subjects will be paid at the rate of $2.00 per hour for a six hour session. A minimum of 15 subjects in each of five groups will be utilized for a total of at least 75 subjects.

Procedures

Subjects will be assigned to one of five groups: a non-smoker group, light and heavy smoker groups, or light and heavy smoker-deprived groups. There will be 15 to 20 subjects in each group.

All subjects will perform on a task which involves tracking and reaction time. They will be tested for six consecutive hours. The tracking task requires a coordinated motor response to a continuously varying display. It is probable that the tracking task utilized in the proposed study will involve the subject keeping a marker on a target, whose position is changed in a random fashion. This is accomplished by means of an aircraft-type control stick. Depressing a button on the control will be the response in the reaction time test. The response will be made to a multiple list of stimuli. Subjects in the deprived groups will have all cigarettes removed prior to testing. Subjects in the smoking groups will be furnished with cigarettes. For these groups, cigarettes will be placed in a container in front of

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1 "Measurement of Tobacco Smoking", Medical Times, Vol. 88, No. 4, April, 1960.

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them. An automobile type lighter will be furnished. This system entails the least amount of physical manipulation which might interfere with the performance tasks. In addition, by means of a closed circuit television system, the subjects will be observed. Data will be obtained concerning the performance on the tasks prior to, during, and after smoking. Analysis of these data will yield some information concerning the effects of smoking on a psychomotor task.

Prior to being placed in the test apparatus, blood will be taken from each subject by pricking his finger. This will also be done after the six hour test session. Similarly, a urine sample will be taken before and after the session. Blood pressure will also be taken before and after the session.

When the subject is seated in the device, various leads from a polygraph will be attached. A shoe and sock will be removed from the left foot and the foot will be strapped loosely into a holder which will prevent gross movements. The pickup for a plethysmograph will be attached to the big toe. Pickup electrodes for a GSR will be attached to the sole of the foot or ankle. An attempt will be made to obtain skin temperature from a pickup attached to the lower calf of the leg. Respiration will be measured from an abdominal pneumograph. Muscle tension changes will also be recorded.

A time sampling procedure will be utilized with the above measures. Recordings will be taken during two five-minute sessions each hour. The following measures, then, are obtained from subjects in each group during the test session.

Perceptual-Motor Tests

1. Tracking--This is a fairly sensitive measure. Performance on tracking tests has been shown to be impaired by a number of stressors such as cold, heat, fatigue, acceleration and confinement. Scores involving duration "off target" and frequency "off target" are obtained.

2. Reaction Time--This measure has been used extensively in stress experiments. Since simple reaction time has shown little sensitivity to stress, a complex reaction time task, involving several signals will be used. It has been found that where several signals are used and the subject must choose the proper stimulus before reacting, stress sensitivity is increased.

Physiological Measures

1. Urine Analysis--Urine samples taken before and after the test session will be analyzed for catechol amines and adrenal steroids. These appear to be relatively sensitive indices of stress.

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2. Blood Pressure--While not a particularly sensitive indicator of stress, a before and after measure might be revealing. Because of its simplicity it is included.

3. Blood Count--There is considerable evidence that a reduction of eosinophils takes place after exposure to stress. Pre- and post-test samples will be taken and comparisons made.

4. Respiration--Results in stress studies have been varied. There is some evidence that respiratory rate increases in emotional arousal.

5. Plethysmograph Readings--Degree of constriction or dilation of peripheral arterioles is an indicator of sympathetic activity. Evidence that blood volume change is related to stress. Also, pulse rate is obtained from plethysmograph readings.

6. Skin Resistance (GSR)--There is considerable work on this measure and it appears to be a relatively sensitive indicator of stress.

7. Electromyograph--Records action potential of skeletal muscle. With increased muscle tension in stress, changes in action potentials are found.

8. Skin Temperature--Stress is reported to produce a fall in skin temperature.

While the number of measures utilized may appear excessive, past experience has shown that a battery of variables is desirable. Even a battery of measures cannot always effectively measure the arousal value of a stressful situation. However, if a number of measures are utilized and a large number of subjects are used, physiological variables that appear to be more sensitive to a given stressful situation for most of the group can be isolated and evaluated.

Data Analysis

Differences between the groups in terms of performance on the tracking and reaction time measures can be tested by means of analysis of variance to determine significance. Analysis of differences between groups and over time will be obtained. Data obtained from several of the physiological measures are also amenable to this type of analysis. Primary evaluation of physiological data will involve comparison of changes in individual subjects over time. However group comparison will also be made.

SIGNIFICANCE OF STUDY

As pointed out previously, little interest has been shown in the effects on individuals of deprivation in smoking. It would seem that this aspect of the total behavioral pattern

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associated with smoking is of significance and may have more striking effects than smoking itself. It can, perhaps, be viewed in the same context as "withdrawal" in the case of other drugs.

As designed, the proposed study should yield information concerning the effects of smoking deprivation in terms of stress or emotional arousal associated with the situation. This will be reflected in physiological measures as well as performance measures. Also, the design is such that the relationship between the degree of normal smoking (i.e., light and heavy) and stress reaction can be obtained.

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